AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A method for stabilizing an image of an object being taken from a video camera, the video camera being moved by a transport mechanism and being controlled by a line-of-sight controller, the method comprising:

receiving a plurality of images of the object; and

for each of the plurality of received images,

~~receiving a velocity and orientation of the transport mechanism;~~

~~receiving an orientation of the camera relative to the transport mechanism;~~

~~receiving a scan and tilt rate of the camera;~~

receiving a distance from the camera to the object

<u>determining a difference between the location of the object within the image and the location of the object within a previously captured image</u>;

calculating an inter-frame stabilization adjustment based on the ~~velocity and orientation of the transport mechanism, the orientation of the camera, the scan and tilt rate of the camera, and~~ distance to the object <u>and the difference between the location of the object within the image and the location of the object within a previously captured image</u>, the inter-frame stabilization adjustment for adjusting the position of a displayed area of an image;

adjusting the position of a displayed area of the image based on the inter-frame stabilization adjustment, wherein the received image is larger than the displayed image and the adjusting of the display of the image moves an area of the displayed image within the received image;

calculating a line-of-sight adjustment for the line-of-sight controller based on the inter-frame stabilization adjustment; and

controlling the line-of-sight controller in accordance with the calculated line-of-sight adjustment.

2. (Original) The method of claim 1 wherein the transport mechanism is an airborne vehicle.

3. (Original) The method of claim 1 wherein the line of sight of the camera is derived from the line-of-sight controller.

4. (Cancelled)

5. (Cancelled)

6. (Previously Presented) The method of claim 1 wherein the inter-frame stabilization adjustment specifies the number of pixels in scan and tilt directions.

7. (Original) The method of claim 1 wherein the controlling of the line-of-sight controller specifies rate of scan and tilt movement.

8. (Original) The method of claim 1 wherein the distance to the object is provided by a range finder.

9. (Original) The method of claim 1 wherein the distance to the object is calculated based on the line of sight of the camera and the difference in altitude of the object and the camera.

10. (Original) The method of claim 1 wherein the velocity of the transport mechanism is relative to the object.

11. (Original) The method of claim 1 wherein the velocity of the transport mechanism is relative to an earth frame of reference.

12. (Original) The method of claim 1 wherein the calculated inter-frame stabilization adjustment factors in field of view of the display.

13. (Previously Presented) A method for stabilizing an image of an object being taken from a video camera, the video camera being moved by a transport mechanism and being controlled by a line-of-sight controller, the image being displayed on a display device, the method comprising:

determining a difference in the location of the object within the image from one frame to the next frame;

calculating an inter-frame stabilization adjustment based on the determined difference;

adjusting the display of the image based on the inter-frame stabilization adjustment to remove small-amplitude jitter;

calculating a line-of-sight adjustment for the line-of-sight controller based on the inter-frame stabilization adjustment to account for large-amplitude jitter; and

controlling the line-of-sight controller in accordance with the calculated line-of-sight adjustment.

14. (Original) The method of claim 13 wherein the determining of the difference includes analyzing scan and tilt rate of the line-of-sight controller.

15. (Original) The method of claim 13 wherein the determining of the difference includes analyzing velocity of the transport mechanism.

16. (Original) The method of claim 13 wherein the determining of the difference includes analyzing line of sight of the camera.

17. (Original) The method of claim 13 wherein the determining of the difference includes analyzing orientation of the camera and the transport mechanism.

18. (Original) The method of claim 13 wherein the determining of the difference includes recognizing the object within the images.

19. (Original) The method of claim 13 wherein the calculated line-of-sight adjustment specifies a scan and tilt rate for the line-of-sight controller.

20-26. (Cancelled)

27. (Currently Amended) An apparatus for stabilizing imagery from an airborne video camera displayed on a display device, comprising:

a mechanical line-of-sight controller for controlling line of sight of the video camera at a specified line-of-sight adjustment rate; and

an electronic stabilization component that provides frame-to-frame image stabilization based on a change in location of an object within the images by adjusting the display of the images to remove small-amplitude jitter and that provides to the mechanical line-of-sight controller a new line-of-sight adjustment rate derived from ~~an amount of frame-to-frame image stabilization~~ the change in location of an object within the images to account for large-amplitude jitter.

28. (Original) The apparatus of claim 27 wherein an amount of frame-to-frame image stabilization is additionally based on velocity and orientation of an airborne

transport vehicle, orientation of the camera relative to the airborne transport vehicle, and distance from the camera to the object within the image.

29. (Currently Amended) The apparatus of claim 27 wherein an amount of frame-to-frame image stabilization is additionally based on the specified line-of-sight adjustment rate.

30. (Original) The apparatus of claim 27 wherein the line-of-sight adjustment rate includes a scan rate and a tilt rate.

31. (Original) The apparatus of claim 27 wherein an image received from the video camera is larger than a displayed image and the electronic stabilization component provides frame-to-frame image stabilization by adjusting the location of the displayed image within a received image.

32. (Original) The apparatus of claim 27 wherein the specified line-of-sight adjustment rate includes a user-specified image flow.

33. (Original) The apparatus of claim 27 wherein the mechanical line-of-sight controller is a motorized gimbal system.

34. (Original) The apparatus of claim 27 wherein the frame-to-frame adjustment keeps the object of the images at the same location when displayed.

35. (Currently Amended) A method for stabilizing images being taken from a video camera mounted on a moving vehicle, the camera having a line of sight being controlled by a line-of-sight controller, the method comprising:

calculating initial coordinates for a viewport, the viewport corresponding to a portion of an image that is to be displayed;

calculating inter-frame stabilization adjustments based on the change in location of an object in a succession of image frames to account for velocity of the vehicle, the inter-frame stabilization adjustments used to electronically move the viewport from one frame to the next frame;

moving the viewport in accordance with the calculated inter-frame stabilization adjustments;

displaying a portion of an image corresponding to the moved viewport;

calculating line-of-sight adjustments for the line-of-sight controller based on the inter-frame stabilization adjustments; and

controlling the line-of-sight controller in accordance with the calculated line-of-sight adjustments.

36. (Original) The method of claim 35 wherein the calculating of the inter-frame stabilization adjustments factors in scan and tilt rate of the line-of-sight controller.

37. (Original) The method of claim 35 wherein the calculating of the inter-frame stabilization adjustments factors in line of sight of the camera.

38. (Original) The method of claim 35 wherein the calculating of the inter-frame stabilization adjustments factors in orientation of the camera and the vehicle.

39. (Original) The method of claim 35 wherein the calculating of the inter-frame stabilization adjustments includes recognizing an object within the images.

40. (Original) The method of claim 35 wherein the calculated line-of-sight adjustment specifies a scan and tilt rate for the line-of-sight controller.

41. (New) A method in a camera stabilization system for stabilizing the display of images received from a video camera attached to an aircraft and controlled by a gimbal-based line-of-sight controller, the method comprising:

receiving a first image from the video camera;

receiving a second image from the video camera;

determining the position of an object in the first image;

determining the position of the object in the second image;

determining an image pixel offset in the scan direction, IPO(S), based on the difference in the position of the object in the first and second images;

determining an image pixel offset in the tilt direction, IPO(T), based on the difference in the position of the object in the first and second images;

determining a pixel offset in the scan direction, PO(S), based on IPO(S);

determining a pixel offset in the tilt direction, PO(T), based on IPO(T);

adjusting the display of an image on a display device of the camera stabilization system based on PO(S) and PO(T);

converting PO(S) to a corresponding scan angle based on the field of view of the camera;

converting PO(T) to a corresponding tilt angle based on the field of view of the camera; and

adjusting the velocity of the line-of-sight controller based on the scan angle and the tilt angle

so that both the display of the image and the line of sight controller are adjusted based on IPO(S) and IPO(T).

42. (New) The method of claim 41, further comprising:

determining aircraft pixel offsets caused by the movement of the aircraft by,

receiving an indication of the velocity of the aircraft in the earth reference frame, $V^{E}_{aircraft}$,

receiving a matrix, C_{BE}, corresponding to the orientation of the aircraft in the earth reference frame,

receiving a matrix, C_{CB}, corresponding to the orientation of the camera,

calculating a transformation matrix, C_{CE}, for transforming form the earth reference frame to the camera reference frame, wherein $C_{CE}=C_{CB}C_{BE}$,

calculating a line of sight, L^E, of the camera in the earth reference frame, wherein $L^E=C_{CE}{}^T(1,0,0)^T$,

determining the distance, K, to an object at the center of the image,

determining the velocity of the aircraft in the camera reference frame, $V^C_{aircraft}$, wherein $V^C_{aircraft}=C_{CE}{}^*V^E_{aircraft}$,

calculating a normalized velocity of the aircraft $V^C_{aircraft}=V^C_{aircraft}/K$,

calculating a first difference in scan units ΔS^C_1, wherein $\Delta S^C_1=V^C_{aircraft}(S)^*\Delta T$, wherein $V^C_{aircraft}(S)$ corresponds to the normalized velocity of the aircraft in the scan direction, and wherein ΔT corresponds to a frame refresh period,

calculating a first difference in tilt units ΔT^C_1, wherein $\Delta T^C_1=V^C_{aircraft}(T)^*\Delta T$, wherein $V^C_{aircraft}(T)$ corresponds to the normalized velocity of the aircraft in the tilt direction,

calculating an aircraft pixel offset in the scan direction APO(S), wherein APO(S)=ΔS^C_1 * P/Z, wherein P corresponds to a pixel density associated with the camera, and wherein Z corresponds to a zoom factor associated with the camera,

calculating an aircraft pixel offset in the tilt direction APO(T), wherein APO(T)=ΔT^C_1 * P/Z

wherein PO(S) is determined based on IPO(S) and APO(S), and
wherein PO(T) is determined based on IPO(T) and APO(T).

43. (New) The method of claim 42, further comprising:

determining camera pixel offsets caused by the rotation of the camera by,

receiving the instantaneous camera scan rate IS,

receiving the instantaneous camera tilt rate IT,

calculating a second difference in scan units, ΔS_2^C, wherein $\Delta S_2^C = IS^* \Delta T$,

calculating a second difference in tilt units, ΔT_2^C, wherein $\Delta T_2^C = IT^* \Delta T$,

calculating a camera pixel offset in the scan direction, CPO(S), based on ΔS_2^C,

calculating a camera pixel offset in the tilt direction, CPO(T), based on ΔT_2^C

wherein PO(S) is determined based on IPO(S), APO(S), and CPO(S), and wherein PO(T) is determined based on IPO(T), APO(T), and CPO(T).